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**Technical code of practice for postharvest handling of major
cut flower products**

主要切花产品采后处理技术规程

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1 Scope

This document establishes the procedure for the postharvest handling of major cut flower products, specifies the operating instructions for the stages of pretreatment, quality grading, bundling and packing, rapid precooling, short-term storage and low-temperature transport, and describes the traceability method for the postharvest handling process.

This document applies to the postharvest handling of major cut flower products.

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Pretreatment solution. A solution containing a bactericide, a respiration inhibitor and similar agents, used on cut flowers after cutting and before packing to improve their tolerance of storage and transport.

3.2 Precooling. The cooling process by which, after cut flowers have been graded and packed and before they are stored and transported, forced convection of cold air, a vacuum environment or a similar means is used to bring the temperature of the flowers down quickly to the temperature required for storage and transport.

4 Postharvest handling procedure

The postharvest handling procedure comprises six stages. The pretreatment stage is divided into five steps, the quality grading stage into two steps, the bundling and packing stage into six steps, the rapid precooling stage into three steps, the short-term storage stage into three steps and the transport stage into four steps. The flow of the procedure is shown in Figure 1.

5.1 Pretreatment

5.1.1 Requirements on people entering and leaving. Everyone entering the postharvest handling premises shall wash and disinfect both hands and change into thoroughly disinfected working clothes, and shall put on overshoes or thoroughly disinfected working shoes. Before leaving the premises they shall wash and disinfect their hands and take off the working clothes and working shoes.

5.1.2 Environment. The pretreatment of cut flowers is carried out in dedicated premises that are tidy, clean and free of pest and disease contamination, in which the ambient temperature and the relative humidity are kept under stable control.

5.1.3 Tools. Flower buckets, secateurs, guillotines and similar tools, and grading, bundling and other machines, shall be thoroughly disinfected before use. The disinfectant should be a chlorine-releasing disinfectant with an available chlorine concentration of 1 000 mg/L, or a

1 % peracetic acid solution.

5.1.4 Preparation. Cut flower products free of pest and disease infection and of mechanical damage should be chosen. Cut flowers entering postharvest handling shall have the leaves on the lowest quarter of the stem removed, which may be done with a leaf and thorn stripping machine.

5.1.5 Treatment with the pretreatment solution. The pretreatment solution shall be chosen according to the characteristics of the cut flower species. For ethylene-sensitive species such as carnation, gypsophila and calla lily, a cut flower pretreatment solution containing an ethylene inhibitor shall be used. For ethylene-insensitive species such as chrysanthemum and gerbera, a cut flower pretreatment solution containing another plant growth regulator shall be used. The ethylene sensitivity types of cut flowers are given for reference in Annex A. The base of the stem is held under water and 1 cm to 3 cm is cut off, and the stem is then put straight into the pretreatment solution. The concentration of the pretreatment solution shall be fixed according to the ambient temperature of the pretreatment and the pretreatment time set. Cut flowers whose base has been trimmed are immersed at once 5 cm to 8 cm into the pretreatment solution and treated for 2.5 h at 20 degrees Celsius or for 4 h at a low temperature of 10 degrees Celsius.

5.2 Quality grading

5.2.1 Environment. The requirements on the grading environment for cut flowers are those of 5.1.2, and grading is carried out at 15 degrees Celsius to 18 degrees Celsius.

5.2.2.1 Manual grading. The cut flowers, once tidied, are placed on the grading table and the length of the stem is measured against a rule. The flowers are graded by judging the size of the head, the form and colour of the flower, the thickness of the stem, the state of stem and leaf, the evenness, the mechanical damage and the pests and diseases by eye. The grading standard is GB/T 18247.1.

5.2.2.2 Machine grading may use three methods. a) Automatic grading by stem length: the length classes are drawn according to the characteristics of the species, the flowers are placed by hand at the infeed of the length grading machine, and the grading standard is GB/T 18247.1. Once sorting is complete, the material of each class is handled separately. The flowers are then graded a second time by judging the size of the head, the form and colour of the flower, the thickness of the stem, the state of stem and leaf, the evenness, the mechanical damage and the pests and diseases by eye. b) Automatic grading by stem weight: the weight classes are drawn according to the characteristics of the species, the flowers are placed by hand at the infeed of the weight grading machine, and the grading standard is GB/T 18247.1. Once sorting is complete, the flowers of each class are handled separately, and they are graded a second time by judging by eye the size of the head, the form and colour of the flower, the thickness of the stem, the state of stem and leaf, the evenness, the mechanical damage and the pests and diseases. c) Comprehensive

automatic grading by image recognition: for each species and variety, a graded image database is built from phenotypic data such as stem length, degree of opening, head size, flower form and flower colour and from data on quality defects such as mechanical damage and abnormality (malformation, off colour, disease). An automatic grading model is then built for each species and variety on its database. Comprehensive automatic grading by image recognition is based on the three main parameters of stem length, head size and degree of flower opening, and is carried out according to GB/T 18247.1.

Example: for automatic grading of cut roses, eight classes are drawn on stem length, namely 45 cm to 50 cm, 51 cm to 55 cm, 56 cm to 60 cm, 61 cm to 65 cm, 66 cm to 70 cm, 71 cm to 75 cm, not less than 76 cm, and short stems (less than 45 cm); two classes, large and small, are drawn on head size; and two classes, large and small, are drawn on the degree of opening.

5.3 Bundling and packing

5.3.1 Environment. The requirements on the packing environment are those of 5.1.2, and packing is carried out at about 15 degrees Celsius.

5.3.2 Case sizes. The size of the packing case shall suit a pallet of 1 219 mm by 1 016 mm. The sizes of the cases used for packing, transporting and storing cut flower products follow Annex B.

5.3.3.1 Outer packing material. The outer packing material for cut flowers shall have good load-bearing capacity, shall not deform easily, shall resist crushing, shall be light and shall be suited to transport at constant low temperature. Vent holes usually have to be made at the two ends of the case, and the area of the openings is 4 % to 12 % of the total area of the face in which they are made. The strength, the closure and the other technical requirements of corrugated cases follow GB/T 6544. Common outer packing materials are polystyrene foam cases or polyethylene foam cases of a certain mechanical strength, polyester board cases lined with polyurethane foam, corrugated cases sprayed with liquid paraffin, reinforced plywood cases and crates.

5.3.3.2 Inner packing material. The inner packing material for cut flowers shall be fresh, clean, non-toxic, non-irritant, undamaged and good at holding moisture. Common inner packing materials are moisture-resistant white paper, white corrugated paper, polyethylene film, plastic sleeves and non-woven sleeves. The size of the moisture-resistant white paper or corrugated paper is 20 cm to 30 cm by 30 cm to 50 cm, and the thickness of the polyethylene plastic film is 0.04 mm to 0.06 mm. Rubber bands, string, tape and the like are used for bundling.

5.3.3.3 Filling material. The filling material may be foam plastic, inflatable plastic film, soft paper and the like.

5.3.4.1 Content of the marking on the case. The marking of the case shall follow GB/T 191